

as 40 kV) is applied across the electrodes, and smoke generated by smoke generating means is introduced into the chamber.

In each of the aforementioned electrical smoking method, the smoke generated by the fire grate or the smoke generating means is supplied with ions thanks to the corona discharge, so that the thus electrified smoke is attracted to the food product acting as an electrode. This results in rapid adherence and infiltration of the smoke to and into the food product, to thereby provide a smoked food having a superior storage characteristic.

However, the aforementioned electrical smoking methods utilize an electric field within a corona discharged area, thereby causing a problem of an extremely large amount of electric power consumption and an enlarged size of the apparatus.

Further, in each of the aforementioned electrical smoking methods, since the corona discharge is conducted between the electrodes and the food product, the smoke ununiformly adheres to and infiltrates into the food product, thereby causing a problem of a deteriorated quality of the smoked food.

It is therefore a first object of the present invention to provide a smoking method and an apparatus therefor capable of reducing the amount of electric power consumption and of downsizing the apparatus.

It is a second object of the present invention to provide a smoking method and an apparatus therefor capable of uniformly adhering and infiltrating smoke to and into a food product such as a farm product to thereby improve the quality of the smoked food.

It is a third object of the present invention to provide a smoking method and an apparatus therefor capable of improving an efficiency of adherence and infiltration of smoke to and into a food product, to thereby effectively utilize the smoke and finish the food product into a delicious smoked food.

## DISCLOSURE OF INVENTION

There will be described the constitution of the present invention for achieving the above objects.

The invention, as shown in FIGS. 1 and 3, is a smoking method comprising the steps of: transporting grounded food products 19 at a predetermined speed into a chamber 11 by transporting means 12, the food products 19 comprising farm products, marine products and livestock products or processed foods thereof, and applying a DC voltage or AC voltage of 7 kV to 15 kV between a pair of electrode plates 13, 14 disposed along the transporting means 12 within the chamber 11 so as to interpose the food product 19 between the pair of electrode plates 13, 14, so as not to start discharge.

According to the smoking method, application of the voltage between the pair of electrode plates 13, 14 leads to generation of an electric field incapable of initiating discharge between the pair of electrode plates 13, 14 to thereby electrify the smoke, and the thus electrified smoke adheres to and infiltrates into food products 19 by a Coulomb force based on the electric potential difference between the pair of electrode plates 13, 14. Further, since no discharge such as corona discharge is initiated between the electrode plates 13, 14 and food products 19, the electrified smoke uniformly adheres to and infiltrates into the food products 19.

The invention, as shown in FIGS. 9 and 10 or in FIG. 11, is a smoking method comprising the steps of: introducing smoke into a chamber 71 containing therein food products 19 and electrode plates 73, 74 alternately arranged with each other at predetermined intervals, and applying a DC voltage or AC voltage of 7 kV to 15 kV between the electrode plates 73, 74 or between the food products 19, so as not to start discharge.

According to the smoking method application of the voltage between the electrode plates 73, 74 or between food products 19 leads to generation of an electric field

incapable of initiating discharge between the electrode plates 73, 74 or between food products 19 to thereby electrify the smoke, and the thus electrified smoke adheres to and infiltrates into food products 19 by a Coulomb force based on the electric potential difference between the electrode plates 73, 74 or between food products 19.

The invention, as shown in FIGS. 12 and 14, is a smoking method comprising the steps of: introducing smoke into a chamber 91 containing therein first and second electrodes 111, 112 arranged at predetermined intervals, and electrically connecting first and second food products 101, 102 to the first and second electrodes 111, 112, respectively, and applying a DC voltage or AC voltage of 7 kV to 15 kV between the first and second electrodes 111, 112 so as not to start discharge.

According to the smoking method, application of the voltage between the first and second electrodes 111, 112 leads to generation of an electric field incapable of initiating discharge between the first and second food products 101, 102 to thereby electrify the smoke, and the thus electrified smoke adheres to and infiltrates into first and second food products 101, 102 by a Coulomb force based on the electric potential difference between the first and second food products 101, 102.

The invention is a smoking method of characterized in that the distance between the adjacent electrode plate and food product or between adjacent food products is 20 mm to 100 mm.

According to the smoking method there can be more assuredly prevented initiation of discharge such as corona discharge or streamer discharge between the adjacent electrode plate and food product or between the adjacent food products.

The invention as shown in FIGS. 1 and 3, is a smoking apparatus comprising: a chamber 11 having opposite ends thereof formed with an inlet 11a and an exit 11b, respectively, transporting means 12 moved into the chamber 11 from the inlet 11a toward the exit 11b, and adapted to transport a plurality of food products 19 spaced at

predetermined intervals, the food products 19 comprising farm products, marine products and livestock products or processed foods thereof, a pair of electrode plates 13, 14 disposed within the chamber 11 at predetermined distances from the food products 19, respectively, along the longitudinal direction of the transporting means 12 so as to interpose the food products 19 between the pair of electrode plates 13, 14, smoke generating means 16 for generating smoke to be adhered to and infiltrated into the food products 19, and for introducing the smoke into the chamber 11, and a high voltage generating circuit 17 adapted to apply a DC voltage or AC voltage of 7 kV to 15 kV between the pair of electrode plates 13, 14 so as not to start discharge, and adapted to ground the food products 19.

The smoking apparatus is an electric field generated which is incapable of initiating discharge between the pair of electrode plates 13, 14 to thereby electrify the smoke, and the thus electrified smoke adheres to and infiltrates into food products 19 by a Coulomb force based on the electric potential difference between the pair of electrode plates 13, 14. Further, since no discharge such as corona discharge is initiated between the electrode plates 13, 14 and food products 19, the electrified smoke uniformly adheres to and infiltrates into the food products 19.

The invention as shown in FIGS. 9 and 10 or in FIG. 11, is a smoking apparatus comprising: supporting tools 71a disposed within a chamber 71 and adapted to support a plurality of food products 19, respectively, a plurality of electrode plates 73, 74 disposed between the food products 19 supported by the supporting tools 71a, at predetermined distances from the food products 19, respectively, smoke generating means 16 for generating smoke to be adhered to and infiltrated into the food products 19, and for introducing the smoke into the chamber 71, and a high voltage generating circuit 17 adapted to apply a DC voltage or AC voltage of 7 kV to 15 kV between the plurality of food products 19 or between the plurality of electrode plates 73, 74 so as not to start discharge.

Moreover, the smoking apparatus may have an electric field generated which is incapable of initiating discharge between the electrode plates 73, 74 or between food

products 19 to thereby electrify the smoke, and the thus electrified smoke adheres to and infiltrates into food products 19 by a Coulomb force based on the electric potential difference between the electrode plates 73, 74 or between food products 19.

The invention as shown in FIGS. 12 and 14, is a smoking apparatus comprising: first electrodes 111 disposed within a chamber 91, and electrically connected to a plurality of first food products 101, respectively, second electrodes 112 disposed within the chamber 91, each of second electrodes 112 disposed between the first electrodes 111 at predetermined distances from the first electrodes 111 and electrically connected to a plurality of second food products 102, smoke generating means 16 for generating smoke to be adhered to and infiltrated into the first and second food products 101, 102, and for introducing the smoke into the chamber 91, and a high voltage generating circuit 17 adapted to apply a DC voltage or AC voltage of 7 kV to 15 kV between the first and second electrodes 111, 112 so as not to start discharge.

In addition, the smoking apparatus may have an electric field generated which is incapable of initiating discharge between the first and second food products 101, 102 to thereby electrify the smoke, and the thus electrified smoke adheres to and infiltrates into first and second food products 101, 102 by a Coulomb force based on the electric potential difference between the first and second food products 101, 102.

The invention is further characterized in that the distance between the adjacent electrode plate and food product or between adjacent food products is 20 mm to 100 mm.

The smoking apparatus can also be characterized in that there can be more assuredly prevented initiation of discharge such as corona discharge or streamer discharge between the adjacent electrode plate and food product or between the adjacent food products.

The invention as shown in FIG. 3, is a smoking apparatus characterized in

that the high voltage generating circuit 17 includes a single transformer 17a for boosting the commercial frequency voltage up to an AC voltage of 7 kV to 15 kV,

that opposite ends of a secondary coil 17c of the transformer 17a are electrically connected to electrode plates 13, 14 or to food products 19, respectively, and

that one end of an intermediate tapping electric wire 47 having the other end electrically connected to the food products 19 or to the electrode plates 13, 14 is electrically connected to an intermediate portion of the secondary coil 17c.

The smoking apparatus may also have one of the pair of electrode plates 13, 14 or of food products 19 becoming plus when the other of the pair of electrode plates 13, 14 or of food products 19 becomes minus. Thus, the electrified smoke between the electrode plates 13, 14 or between the food products 19 is immediately forced along the electric field generated between the electrode plates 13, 14 or between the food products 19 to thereby adhere onto and infiltrate into the food products 19.

The invention as shown in FIG. 15, is a smoking apparatus characterized in

that the high voltage generating circuit 127 includes identical first and second transformers 121, 122 for boosting the commercial frequency voltage up to an AC voltage of 7 kV to 15 kV,

that one ends of secondary coils 121b, 122b of the first and second transformers 121, 122 are electrically connected to electrode plates or to food products, respectively, and

that the other ends of the secondary coils 121b, 122b of the first and second transformers 121, 122 are electrically connected to food products or to electrode plates, respectively, via common electric wire 123.

The smoking apparatus may also have the electrified smoke is immediately forced to adhere onto and infiltrate into the food products.

The invention as shown in FIG. 3 or in FIG. 15, is a smoking apparatus characterized in that the intermediate tapping electric wire 47 or the common electric wire 123 is provided with a diode 52a, 53a for rectifying the electric current flowing through the intermediate tapping electric wire 47 or the common electric wire 123.

It also becomes possible to give a desired plus or minus electric charge to the smoke. This ensures adherence and infiltration of the desired smoke onto and into food products, to thereby enable manufacture of a smoked food having a desired taste.

The invention as shown in FIGS. 1 and 4, is a smoking apparatus of anyone of claims 5 through 7, characterized in that the smoke generating means 16 includes: a hopper 22 for storing a smoking material 21, a screw conveyor 23 for transporting the smoking material 21, a burn heater 24 for incompletely burning the smoking material 21 transported by the screw conveyor 23, to thereby generate smoke, and a smoke inlet 26a for introducing the smoke into the chamber 11.

The smoking apparatus is a simple supply of the smoking material 21 into the hopper 22 enables automatic generation of the smoke and automatic introduction of the smoke into the chamber 11. Further, since the flow rate of the smoke can be extremely reduced, the efficiency of adherence and infiltration of the smoke onto and into food products 19 can be improved.

The invention as shown in FIGS. 4 and 5, is a smoking apparatus further comprising: an ionizing electrode wire 39 provided across a smoke inlet 26a for passing the smoke therethrough, the ionizing electrode wire 39 being applied with a DC voltage or AC voltage of 6 kV to 10 kV.

There is initiated streamer discharge between the ionizing electrode wire 39 and the smoke to thereby previously electrify the smoke.

Here, streamer discharge does mean discharge in which electrons accelerated by an electric field collide with gaseous molecules so as to successively ionize

the gaseous molecules into a plasma state, to thereby convert a gas into a conductive matter. Note, during progression of the streamer discharge, electrons are increased in an avalanche manner, and there are observed plasma columns called streamers which comprise electrons and positive ions and are accompanied with light generation.

The invention as shown in FIG. 9 or FIG. 12, is a smoking apparatus of anyone of claims 5 through 7, further comprising: smoke circulating means 77 or 97 for circulating the smoke introduced into the chamber 71 or 91, wherein the smoke circulating means 77 or 97 comprises: a circulation duct 78 or 98 having opposite ends communicated to an upper part and a lower part of the chamber 71 or 91, respectively, and a fan 99 disposed within the circulation duct 78 or 98 so as to draw the smoke at the upper level within the chamber 71 or 91 into the upper end of the circulation duct 78 or 98 and to discharge the smoke from the lower end of the circulation duct 78 or 98 into the chamber 71 or 91.

Also operation of the fan 99 causes the smoke at the upper level within the chamber 71 or 91 to be drawn into the upper end of the circulation duct 78 or 98 and then to be discharged into the chamber 71 or 91 from the lower end of the circulation duct 78 or 98. This enables circulation of the smoke introduced into the chamber 71 or 91, to thereby allow utilization of the smoke without wastefulness.

The invention as shown in FIG. 3, is a smoking apparatus of anyone of claims 5 through 7, characterized in that condiments are added into a liquid 57c within a tank 57b of a humidifier 57 for keeping the humidity within the chamber 11 constant.

Also, operation of the humidifier 57 causes the condiments to be introduced into the chamber 11 together with the liquid 57c atomized by the humidifier 57, to thereby adhere onto and infiltrate into food products 19.

The invention as shown in FIG. 20, is a smoking apparatus characterized in that the supporting tools 71a and plurality of electrode plates 73, 74, or the first and second



electrodes, are provided on a rack 221 to be removably moved into the chamber 71, and that the supporting tools 71a and plurality of electrode plates 73, 74, or the first and second electrodes, are electrically connected to the high voltage generating circuit via contact type electric collector 222.

According to another embodiment attaching and removing food products 19a, 19b to and from supporting tools 71a or first and second electrodes can be conducted outside the chamber, thereby improving food productability.

### **IN THE ABSTRACT**

An inlet (11a) and an exit (11b) are formed at opposite ends of a chamber (11), and transporting ~~means~~ device(12) is moved into the chamber from the inlet toward the outlet. The transporting ~~means~~ device is constituted to transport a plurality of works (19) at predetermined intervals. Disposed within the chamber is a pair of electrode plates (13, 14) along the longitudinal direction of the transporting ~~means~~ device and at predetermined distances from the works, respectively so as to interpose the works between the pair of electrode plates. Smoke to be adhered to and infiltrated into works is constitutionally generated by smoke generating ~~means~~ device (16) and introduced into the chamber. Applied between the pair of electrode plates is a DC voltage or AC voltage of 7 kV to 15 kV by a high voltage generating circuit, and works are grounded, this reduces the amount of electric power consumption, downsizes the apparatus, and renders the smoke to uniformly adheres to and infiltrates into works, to thereby improve the quality of smoked foods.